Study on the Construction of Financial Management Target System of Science and Technology Enterprises Based on AHP and MOP Method

Jia-wen MA¹,a,*

¹School of Management, Wuhan University of Technology, Wuhan, Hubei, China

ªmjwforwork@163.com

*Corresponding author

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Abstract. In the course of enterprise vigorous development, the enterprise life cycle is short, the development degree is limited and so on many problems come one after another. Based on science and technology enterprises, this paper fully combines the goals of different stakeholder groups with the overall goals of science and technology enterprises through analytic hierarchy process and multi-objective optimization model, constructs the overall financial management objective system of enterprises and puts forward the final goal of comprehensive benefit optimization. It is expected that under the political and economic environment of fierce competition, scientific and technological enterprises should strengthen the management of all stakeholders, achieve the financial management objectives of enterprises and promote the development of enterprises.

1. Introduction

With the urgent need for the transformation of the domestic economic growth model and the introduction of many preferential policies by the Ministry of Science and Technology, China's science and technology enterprises have mushrooming. However, development is always in line with the problem. Rui Guo [1] points out that high-tech enterprises pay insufficient attention to financial management and cannot innovate financial management mode from the perspective of value chain. Many emerging technology enterprises only pay attention to product research and development and short-term profit, which threaten the sustainable development of enterprises. The technology enterprise base is huge but the enterprise life cannot last, this phenomenon is worth pondering deeply. This paper will explore from the perspective of financial management objective system of science and technology enterprises.

The goal of enterprise financial management is the cornerstone and driving force of enterprise financial operation, which determines the sustainable development ability of enterprise. At present, some scholars have divided and combined the financial goals of science and technology enterprises in different periods based on the life cycle theory [2]. However, the author believes that the financial management goals of enterprises should not only be replaced by the goals in different periods. After considering the research results of contract theory and game theory, the author agrees that enterprise value is the result of the joint effort of all parties [3]. At the same time, it is proposed to reasonably integrate the existing goals focusing on different stakeholders to form a financial management goal system that can flexibly respond to various environmental changes and changes in the development stage of the enterprise.
2. The Uniqueness of Financial Management in Science and Technology Enterprises

Firstly, the financial management objectives of science and technology enterprises should not only focus on the accumulation of enterprise wealth, but also pay attention to the development of scientific and technological capabilities. For science and technology enterprises, core creativity and continuous innovation ability constitute the source power for long-term continuous development of enterprises, and play an important role in enterprises. Therefore, financial goals that focus solely on maximizing shareholder wealth and corporate value cannot directly link core technologies with the sustainable development of enterprises, and their applicability to science and technology enterprises is limited. Secondly, intellectual capital will become an important form of capital for science and technology enterprises. The emergence of intellectual capital makes the value of an enterprise not reflected in the size of the enterprise and the number of sales, but in the quantity and quality of intellectual capital [4]. This requires enterprises to pay more attention to the interests of professionals and coordinate the interests of professionals with the company's overall financial management objectives. Thirdly, science and technology enterprises have high research and development costs and a large amount of capital needs in the product seed stage and development stage, so they need to have strict capital management, credit supervision mechanism and financial management target system that can protect all stakeholders. Finally, due to the particularity of their products and services, science and technology enterprises often need the assistance of a large number of external participants, so that they have a large number of external stakeholders. Therefore, science and technology enterprises need to pay more attention to the interest needs of all stakeholders. For example, some large and medium-sized science and technology enterprises tend to outsource labor-intensive business, which requires enterprises to balance the interests of important outsourcers when constructing the target system. The products and services of science and technology enterprises largely depend on the network publicity and sales, so the enterprises will establish a cooperative relationship with the platform. When an enterprise overcomes the problem of low success rate in the initial stage, once the product or service is successful in the market, it can grow at a faster speed. However, the huge risks and liquidity problems arising in the process need to be regulated by a sound financial management system.

3. Content of Financial Management Target System

In the financial management objectives that have been proposed with high recognition, the shareholder wealth maximizes the interests of the shareholder and makes the shareholder differ greatly from other stakeholder groups. Enterprise value maximization focuses on the control and analysis of enterprise risks, considering other stakeholders of the enterprise, but it is still difficult to reflect and measure the interests of stakeholders other than shareholders and creditors. On this basis, the author proposes to divide all stakeholders of an enterprise into relatively independent groups, including shareholder group, creditor group, employee group, customer group and other external stakeholder groups, so as to establish the overall financial management objective of the enterprise to maximize the overall interests. Each interest group has corresponding interest objectives, and these objectives will directly constitute the elements of the enterprise's overall financial management objectives. The overall value of the enterprise is determined by all interest groups, and the overall financial management goal of the enterprise can be maximized by optimizing the financial management goals of each interest group.
3.1. The Financial Goal of Shareholder Groups

Take the maximization of shareholder value as the financial goal of the shareholder group. Similar to traditional enterprises, shareholders of science and technology enterprises play the roles of owners and providers of enterprise capital in enterprises, whose purpose is the continuous growth and accumulation of personal wealth. Shareholders of science and technology enterprises often take high risks due to their high financial risks, and at the same time enjoy high potential returns. The maximization of shareholder value centers on the interests of shareholders, promotes the company to be oriented by interests from the perspective of shareholders, and improves the operating efficiency of the company. This goal guarantees the basic interests of shareholders as owners and is of great benefit to the shareholder group considering the time value and risk of earnings.

3.2. The Financial Goal of Creditor Groups

Take the optimization of solvency as the financial goal of creditor groups. Creditors are another important provider of enterprise capital. In the early stage of the development of science and technology enterprises, huge capital injection is needed, and it is obviously insufficient to rely only on internal capital contribution, so creditors' needs are constantly paid attention to. Because creditors have limited benefits from the enterprise and are greatly affected by the sustainable operation of the enterprise, creditors often attach importance to the enterprise's ability to repay capital and interest and its sustainable operation in the future. The optimization of debt paying ability does not mean the maximization of enterprise's debt paying ability, which should be based on the debt paying ability index or industry average level expected by creditors. Excessive debt guarantee may lead to the damage of enterprise's profitability and threaten the interests of shareholders.

3.3. The Financial Goal of the Employee Group

Take the optimization of employees' reasonable claim right as the financial goal of the employee group. Employees' right of claim can be understood as employees' right of discourse and claim for existing or future problems or situations. Different from traditional enterprises, the importance of human capital is particularly prominent in science and technology enterprises. However, due to the difficulty in effectively measuring its value through external information and other reasons, the company often ignores the interests of core personnel in the construction of financial management objectives, and the insufficient incentive plan of employees makes it impossible for employees to combine the overall interests of the enterprise with their own interests. Only when the enterprise gives reasonable consideration to the interests of employees, employees will make greater contributions to the overall goals of the company. The addition of this goal requires science and technology enterprises to pay more attention to the "people-oriented" business philosophy and pay more attention to the further development and rational and effective use of human resources.

3.4. The Financial Goal of Customer Groups

To maximize customer satisfaction and loyalty as the financial goals of customer groups. As the main business income source and the ultimate beneficiary of products and services, the customer group is closely related to the enterprise. Enterprises rely on the development of customers, customers enjoy the products and services provided by enterprises. Although there is a huge conflict between the profitability of enterprises and customers' requirements on the cost performance of products and services, enterprises still need to focus on the interests of consumers. For
software-services tech companies, feedback from their customers will have a greater impact on their financial performance than from traditional corporate customer groups. Therefore, enterprises need to give full consideration to the interests of customer groups. Through the analysis of the nature and positioning of the products and services provided, this paper tries to find a balance point suitable for the enterprise between meeting the profit requirements of the enterprise and improving customer satisfaction and loyalty.

3.5. The Financial Goal of Other External Stakeholder Groups

Optimize the expected rate of return of the cooperative project as the financial goal of other external stakeholder groups. The research and development and promotion of products of science and technology enterprises need to rely on the help of more external participants, and "cooperation" has become the key word between enterprises and external participants. For science and technology enterprises, suppliers, outsourcers and Taiwan businessmen are important external participants of most of them. Enterprises hope to reduce project costs, while external participants hope to maximize profits, which requires enterprises to balance the interests of external participants and find the expected return that both parties can accept.

4. The Construction of Enterprise Financial Management Target System

Based on the previous analysis of various interest groups in the technological enterprise financial management objective system, the author decomposes the decision problem into different hierarchical structures according to the order of the general objective, sub-objectives and indicators of each level by analytic hierarchy process, and then performs calculation on the judgment matrix to obtain the priority weight of each element at each level to an element at the upper level. Finally, the author constructs the restriction equations of each middle-level objective and the objective equation satisfying the comprehensive interest optimization by using the multi-objective optimization model.

4.1. Building up a Hierarchical Model

The author takes the maximization of comprehensive interests as the top goal, the financial goals of each interest group as the middle goal of the model, and the related indexes of the financial goals of different interest groups as the factor layer at the bottom. The hierarchy model is shown in Figure 4-1 as follows.
4.2. Construct Judgment (Pairwise Comparison) Matrices

For a certain layer of targets, the target scale value is defined as $a_i (i = 1, \ldots, n)$. When comparing the importance of the element $i$ with the element $j$ relative to a factor at the next level, the relative importance of $a_{ij}$ is expressed quantitatively. Assume that there are $n$ elements involved in the comparison, then the matrix can be expressed by:

$$
A = \begin{pmatrix}
    a_{11} & \cdots & a_{1n} \\
    \vdots & \ddots & \vdots \\
    a_{n1} & \cdots & a_{nn}
\end{pmatrix} = (a_{ij})_{n \times n}
$$

According to this definition, a judgment matrix with five middle targets is constructed as:

$$
A = \begin{pmatrix}
    a_{ij}
\end{pmatrix}_{5 \times 5}
$$

The Numbers 1-9 and their reciprocal are used as the scale, and the specific meaning is based on the scale meaning table. Science and technology enterprises will make decisions on each scale value according to the specific implementation situation.

4.3. Hierarchical Single Sort and Consistency Check

The judgment matrix is solved by the sum method as follows:

$$
\begin{align*}
    b_{ij} &= \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}, \ (i, j = 1, 2, \ldots, n) \\
    C_i &= \sum_{j=1}^{n} b_{ij}, \ (i = 1, 2, \ldots, n) \\
    W &= \frac{C_i}{\sum_{i=1}^{n} C_i}, \ (i = 1, 2, \ldots, n) \\
    \lambda_{max} &= \sum_{i=1}^{n} \frac{(AW)_i}{nW_i}, \ (i = 1, 2, \ldots, n)
\end{align*}
$$
Then we can get the weight $W = (W_1, W_2, \ldots, W_n)^T$ and the maximum eigenvalue of the matrix $\lambda_{max}$, after that we calculate:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

$$CR = \frac{CI}{RI}$$

The value of $RI$ is obtained by querying the mean consistency indicator table.

When $CR < 0.1$, it is judged that the pairwise comparison matrix has satisfactory consistency or its inconsistency degree is acceptable. Otherwise, the pairwise comparison matrix is adjusted until satisfactory consistency is achieved.

### 4.4. Total Hierarchical Ordering and its Consistency Check

Since each factor corresponds to a single middle level target, the importance value of each factor level indicator to the highest level target is the weight value of relevant factors to the middle level target multiplied by the weight value of the middle level target to the highest level target. For the model established in this paper, the corresponding weights of the five middle-level targets and their factor level indicators need to be calculated respectively through the method in the previous step, and then multiplied with the corresponding values in the weights of the middle-level targets and the top-level targets $W = (W_1, W_2, \ldots, W_n)^T$.

### 4.5. Establishing the Comprehensive Benefit Optimization Model

In order to enhance the intelligibility of the model, this paper establishes an optimal model based on the constraints of middle-level objectives. The author thinks that:

1) The overall goal of financial management of science and technology enterprises is the optimization of comprehensive benefits, and the overall goal is expressed by $V$;

2) Comprehensive benefit optimization is the result of the joint effort of the financial goals of each interest group, which is influenced by the financial goals of each group. The model of the overall goal and the financial goals of each group is expressed by $V = f(R_1, R_2, R_3, R_4, R_5)$;

3) Each group has different weights on the importance of the financial target to the overall target. The weight of each group's financial target to the overall target is expressed by $W = (W_1, W_2, W_3, W_4, W_5)^T$;

4) To make each factor dimension the same, consider the following: Divide each goal by the standard value $D_i$ then we can get $h_i = \frac{R_i}{D_i}$. Then the objective function of comprehensive benefit optimization is defined as the weighted average sum of the financial objective influence of each group;

5) The financial objectives of each group are affected by its factor level indicators, and the degree of impact of the indicators is determined by the weight;

6) Due to the influence of specific indicators and other factors of interest conflicts, the financial objectives of each group will be limited. However, in the theoretical state, each group will
expect its interests to be maximized. Therefore, when solving the optimization model in this paper, only the lower limit required by interest groups will be considered, which can be expressed as \( G = (g_1, g_2, g_3, g_4, g_5) \);

7) Due to the uncertainty and variability of group interest constraints, there is no equality constraint in the constraints.

Based on the above conditions, the author expressed the comprehensive benefit optimization model as:

\[
\max V = W^T H = W = (W_1, W_2, W_3, W_4, W_5)^T (h_1, h_2, h_3, h_4, h_5)
\]

\[
\begin{align*}
\alpha_1 R_1 + \alpha_2 R_1 + \alpha_3 R_1 & \geq g_1 \\
\beta_1 R_2 + \beta_2 R_2 + \beta_3 R_2 & \geq g_2 \\
\gamma_1 R_3 + \gamma_2 R_3 + \gamma_3 R_3 & \geq g_3 \\
\delta_1 R_4 + \delta_2 R_4 & \geq g_4 \\
\epsilon_1 R_5 + \epsilon_2 R_5 & \geq g_5 \\
h_i & = R_i / D_i
\end{align*}
\]

Where \( \alpha_i (i = 1, 2, 3) \) represents the weight of each indicator on the goal of maximizing shareholders' interests, \( \beta_i, \gamma_i, \delta_i, \epsilon_i \) are the same.

The above is through the decision of the importance between the factor level index and the middle level target, the middle level target and the top level target, and the construction of the optimization model under the multi-objective. According to the model, enterprises can establish the financial management target system according to the requirements of enterprise management in practical application. The application of this model will help science and technology enterprises to reasonably manage the financial goals of many stakeholders, pay attention to the interest groups that have the most far-reaching impact on the enterprise, reasonably integrate the target demands of various stakeholders and achieve the effect of maximizing the comprehensive benefits of the enterprise.

5. Conclusion

This article takes the science and technology enterprise as the main body, puts forward the construction comprehensive benefit maximization enterprise financial management target system. Through the weight analysis of each stakeholder's financial objectives and their related indicators and the construction of the optimization model, the enterprise's overall financial management objective system is formed. This system directly links the interests and core driving forces closely related to science and technology enterprises with the long-term development of enterprises, and reasonably weakens the problems affecting the long-term development of enterprises such as shareholder independence and interest conflicts in the current market. Science and technology enterprises should consider the overall financial management objectives from an overall perspective, and constantly improve themselves through the establishment of the financial management objective system to achieve long-term sustainable development.
References


